



Laboratory Eleven

Advanced SLC Design

Basic Concepts

1. A *sequence detector* is a SLC which looks for and identifies specific input sequences, like a digital combination lock.
2. *State assignment* is the process of establishing a specific binary code to each state of a state diagram or table.
3. The complexity of a SLC circuit may often be reduced by choosing a state assignment other than a counting sequence.

Note: This prelab assignment is worth 10 points. Lab is still 10.

Task One: A 4-State Sequence Detector

Consider the design of a 4-state sequence detector, similar to that presented in lecture. Record the results of your work in your lab notebook.

1. (Pre) Draw a block diagram for the sequence detector prescribed by the state diagram shown at right, which outputs $Z = 1$ anytime the input sequence $X = 0110$ is observed. In your design, include a **RESET** input for asynchronously clearing the circuit.
2. (Pre) Draw a state table in terms of states a , b , c and d .
3. (Pre) Make a state assignment for this SLC and derive, showing the SLC design steps 3-5 used in Lab 10, a set of **JK** flip-flop design equations. (Note that state a should always be 00.) Refer to the [state table](#) and [design#1](#) and [design#2](#) for the example 4-state sequence detector given in lecture (a similar, but not identical example).
4. (Pre) Repeat Step 3 of the pre-lab but with a different state assignment for states b , c and d . We are going to make two contrasting designs.
5. (Pre) If your **JK** design equations of Step 4 above are about the same order of complexity as Step 3, search for a even more contrasting design implementation (either a more or less complex design) by repeating Step 4 of the pre-lab a second time.
6. Simulate your best design using **ABEL** code and **ModelSim**. Test your design using the sequence $X = 0110110$, and plot waveforms for outputs $Y1$, $Y2$ and Z .
7. Implement and download your best design to the Digilent board, using proper UCF pins for inputs, state variables and outputs. Test your design using various sequences.

